Magic Mirror Costume

Written By: Matthew Varas

🔧 TOOLS:

- Brad Nailer (1)
- Chop saw (1)
- Nylon case tool (optional) (1)
- Screwdrivers (1)
- Tape measure (1)
- Utility knife (1)

⚙ PARTS:

- 15" LCD Monitor (Preferably 12V in) (1)
- Cheap Picture Frame (1)
- 1x2 Furring Strip (1)
- Can of expanding foam (1)
- Plexi Glass (1)
- Mirror Finish window tint (1)
- AA Battery Holders (1)
- Drywall screws (1)
- Silicon Caulking (1)
- laptop (1)
- USB Numberpad (1)
- 1.2V NiMH Rechargeable batteries (2000 mAh) (20)
- Wire (1)
- heatshrink tubing (1)
- Steel wire (1)
- Double Stick Tape (1)

SUMMARY

This is the follow up to my [Chomping Pacman Costume](#)

There are plenty of resources out there for creating magic mirrors, but I wanted to take things one step further. Everything that found was for an installation, and I wanted to find a way to make it into a wearable Halloween costume.

My idea for a frame has turned out to be a royal pain, and if I were to do this again I would try to come up with a better solution.

Here's a video

Step 1 — Magic Mirror Costume
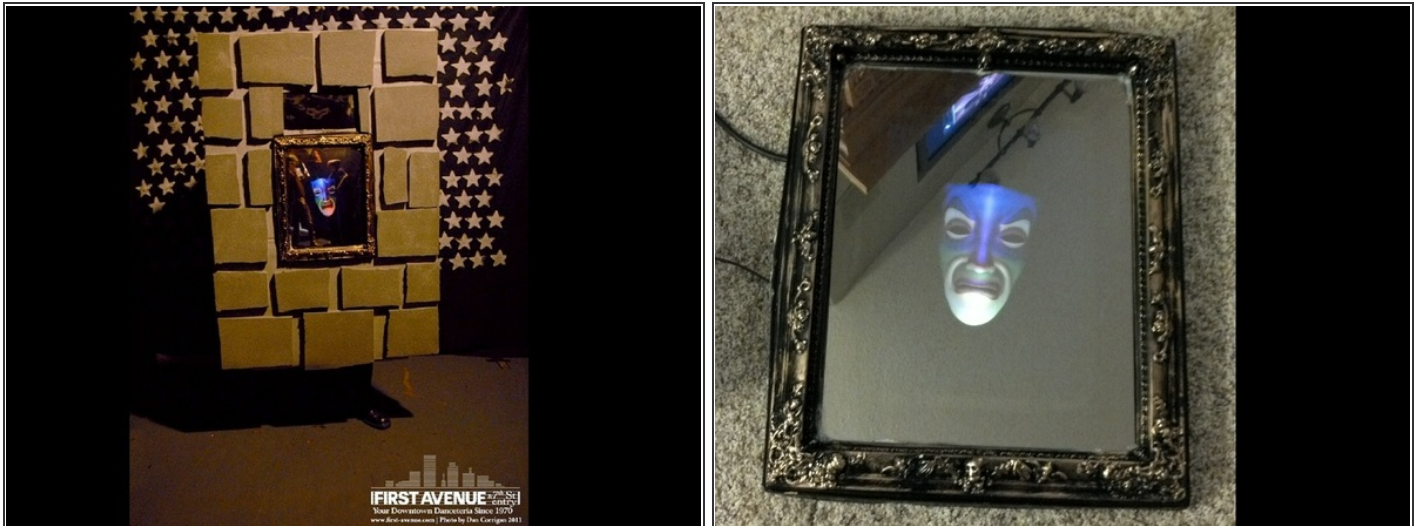
- I went through a few ideas, which will probably happen in the future, but for now I decided on something I could get working quickly and without too horribly much fuss. I took the idea of a magic mirror from [DIY Magic Mirror](#) and used one of the original puppets from [ImaginEERIEing](#) and started putting it all together the other day. I'm planning on building a stone wall costume to wear and mount the mirror on, so this will be another large costume, but not as large as Pacman and Ghost.

Step 2

- I was looking for a way to make this thing without using a heavy wooden frame that wouldn't give me many options for support, and any of the wooden ones that were of the ornate style that I'm looking for are very heavy. Since I'm going to be wearing it around, weight is an issue. I started out by picking up a Lenticular from an unnamed Seasonal Halloween store, and when I told the manager that I was just going to tear it up he gave it to me for $4.99 instead of the $24.99. This was the picture that I picked up

- Next I needed an LCD screen, so I went pawn shopping. Most LCD's take A/C directly, but I didn't feel like trying to find a suitable place on the controller board to tap in with low voltage DC so I went looking for one that used an external power supply, just like a laptop does. After four stores I got lucky, and someone had even misplaced (or stolen) the power supply so they gave me the monitor for half price, which ended up being a total of $20. I used a 15" 4:3 monitor, and because that's the older style and I'm cheap, it's a pretty shoddy screen.

- This takes 12V DC in, which makes it a very easy unit to work with. The only downside is that it is

an old and inefficient monitor, so it draws 1.3 amps at full brightness, which will make life difficult when it comes to batteries. A new one with local dimming would have made for a much nicer final product, but that would have meant buying something brand new just to tear it apart.

Step 3

- I removed the lenticular from the frame to leave behind a super-cheap piece of junk plastic frame.
- I cut a piece of plexiglass and used silicon to glue it into the frame.
- To add stability I built a cheap inner frame out of 1x2 furring strips.

Step 4

- After test-fitting the wood frame, I had to do some trimming to make it fit well.

- After Pacman, I learned that expanding foam is amazing if you need to attach two strange things together, plus I figured it would fill up all of the extra space and make the whole thing more rigid. It makes a giant mess, and of course I used too much.

- Once the foam was in place, I just pressed the wood frame into it, and got to work cleaning up the explosion of foam that resulted.

Step 5

- Next I disassembled the LCD and discarded everything except the panel, the internal mounting frame, controller board/inverter board, and button boards. I got lucky and the mounting tabs were spaced perfectly for me to use some scrap wood as a bracket system. Here is the inner frame with the two wooden brackets installed.

- Then I test-fitted it into the mirror frame before filling it with foam (sorry, I realize the pictures aren't all in perfect order).

Step 6

- I re-installed the LCD in its mounting frame now that the dirty work was done, and did another test fit to make sure everything fit together well.

Step 7

- Now as I'm sure you've noticed, this isn't a mirror, it's just clear plexiglass. I picked up some Mirror Finish Privacy window tint from Lowes to take care of this problem. Since the idea is that the LCD will show through the mirror I needed a two-way mirror solution. This stuff works exactly the way I need it to and it's fairly inexpensive.

- I looked into some glass options, and even ordered a sample of glass that's built just for this type of setup, but I don't feel comfortable carrying around a large hunk of glass. The edges of the tint don't like to stick well, so I added a strip of clear silicone around the edge to glue the tint in place and prevent any peeling. I'll finish this once the adhesive on the tint has had a week or so to fully cure.

- Here are pictures of the mirror window tint installed. Follow the directions that come with the tint for installation.

- In retrospect I should have tinted the plexi before installing it in the frame; that way I could have wrapped the edges around and glued them in place.

- To prevent edge peel I have used silicone caulking around the edges to hold everything in place.

Step 8
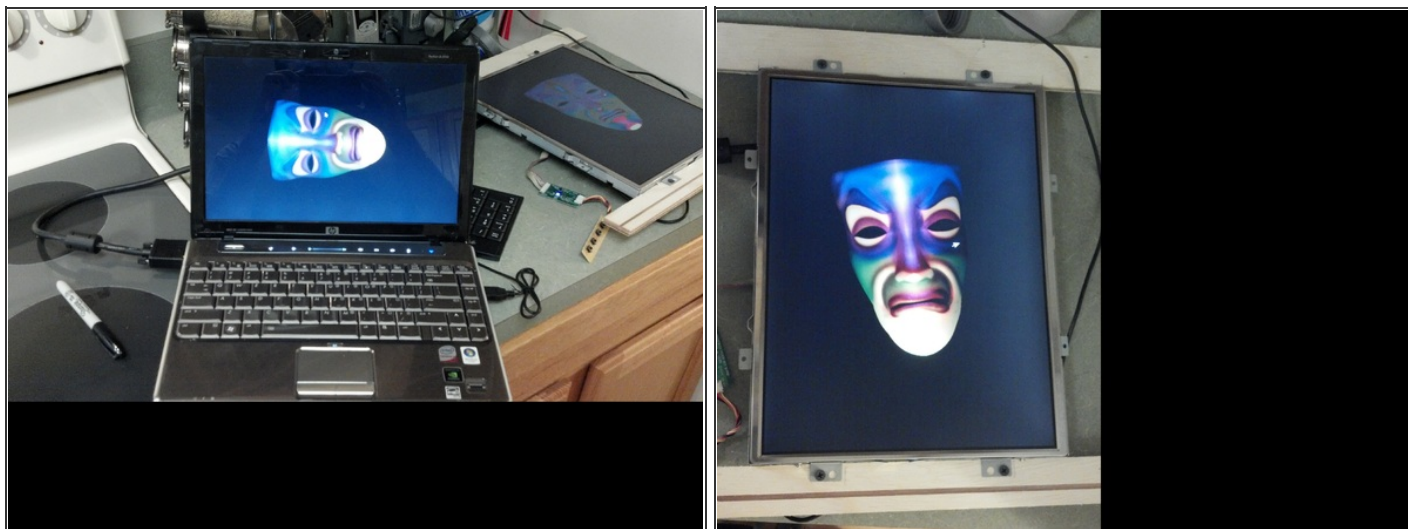
- Now it is time to get the software up and running, and hook the laptop up to the LCD panel. The digital puppet software comes from ImaginEERIEing.

- The software is very self-explanatory, so there isn't much for me to say about it.

Step 9

- Now it's time to attach the LCD frame to the picture frame. I just used four 1" drywall screws so it can be removed if necessary.

- The other two pictures show the final result.

- As you can see in the last two pictures, there was a fair amount of light shining through from the entire LCD panel so you could see the full outline through the mirror. This is not to my liking.

Step 10

- To fix this I decided to try and use some kind of black-to-clear color gradient along the edges to help hide backlight where the mask won't appear. The downside of this approach is that it limits me from using some of their other digital puppets, so I may re-think this again. After hunting for transparency film that I could print in my inkjet printer (and discovering that it costs $60 at Staples) someone suggested that I try Kinko's/Fed-Ex. It turns out that they print transparencies for $0.75/sheet so I drove on down and had my gradients printed out.

- I ended up doubling the transparencies up to get a better effect. They still need some adjusting, and had I used a newer LED-backlit LCD they may not even have been necessary.

- The second picture is one of the gradients; the third picture is the mirror with the transparency gradients installed. When it's dark out you can still see light bleed, but it's not as bad.

Step 11

- Power

- Batteries are the next step. I did a battery drain test using ten batteries with the backlight at full and got 1:20 out of it. At the lowest backlight brightness using two parallel banks of ten batteries each, I got 3:40 out of it. That's plenty of time.

- The batteries are set up as two banks of ten series-connected 1.2V NiMH batteries run in parallel. All of the batteries are rated at 2000 mAh, so the whole thing is good for 4000 mAh. I couldn't find 10 AA holders locally so I'm using an 8 and a 2 for each bank.

- To attach the battery holders I used the same clear silicone to hold them in place that I used for the plexi; it seems like it should be a good choice to bond to the slippery plastic of the battery holders as well as the wood. The holders have little holes in the ends of them, so I also ran some steel wire through each one and tied it of to screws so the silicone isn't the only thing holding them in place, and if it fails the wire should keep them from falling off.

- Durability is the name of the game here. I also soldered up the wires and put heat-shrink on all of the connections to prevent any risk of shorting or tape coming off. There is some electrical tape on there, but it's only there to help keep some of the wires neat. I also chose to run the wires on the mirror frame, not on the LCD or the mounting bracket. This way I can remove the LCD easily by simply unplugging it

- First picture: Initial battery test. Second picture: Batteries installed. Third picture: my mounting system for the battery packs.

Step 12

- [Here](#) is a video shot at our local maker space (The Hack Factory in Minneapolis).

- I re-mapped the keys of a USB numberpad to control the puppet using [Sharp Keys](#) and then popped the unused keys off. This is so I can tell where I am just by feel since I won't be looking at the keypad.

- Finally a few pictures of the mirror completed.

- The next step will be to build the wall costume portion of the project and attach the two.

Step 13
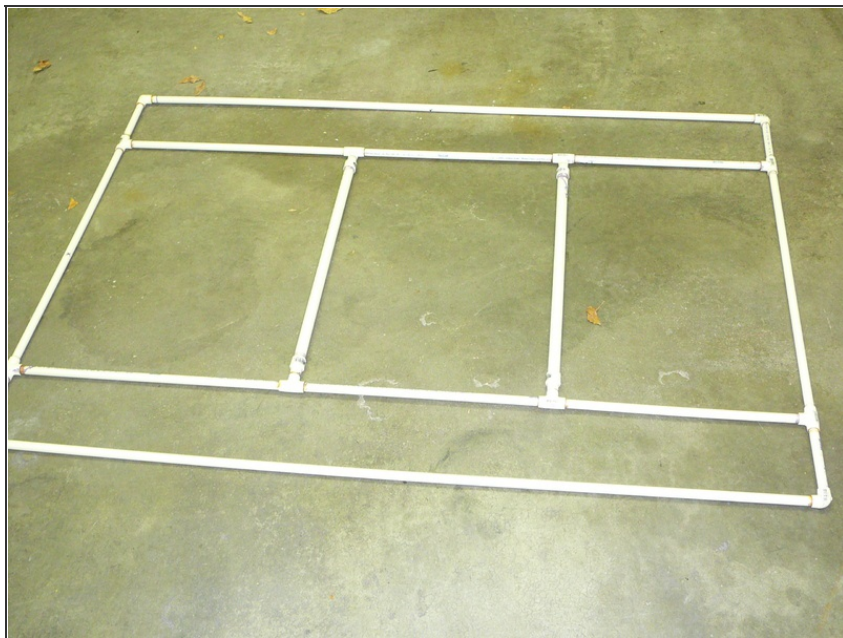
- Build the wall frame

- After having a lot of success on Pacman I decided to build the wall frame out of CPVC pipe.

- CPVC has a few major advantages for making a frame: It's light weight, it's cheap, it's easy to assemble, and there are tons of joint options out there so you don't have to get creative with ways to connect two pieces.

- It's not that sturdy on its own, but by attaching it to cardboard you create an extremely sturdy structure. Expanding foam works well to make the attachment.

- This is the wall frame. It's mostly made of 1/2" pipe, but those two crossbars are 3/4" and are where the mirror itself will attach as well as the harness.

Step 14

- I'm using an external-frame backpack frame for my setup. It came from a surplus store (Not military surplus, they charge a lot more than normal surplus stores) and I discarded the bag portion of the backpack.

- I attached two pieces of 3/4" CPVC to the pack frame to act as attachment points. On one I used some zip ties and a lot of electrical tape, the other is just attached with electrical tape. It doesn't sound like it would be sturdy, but it works wonders (and is cheap if you buy a 10 pack of the cheap stuff)

- This project needs a hip belt to work correctly since the weight will cause the whole thing to tip forward. A hip belt will prevent this from happening, and my pack came with one built in.

- I realize that a simple sandwich sign or something similar would have been much more simple, but it's fun to overbuild things and I like the process involved.
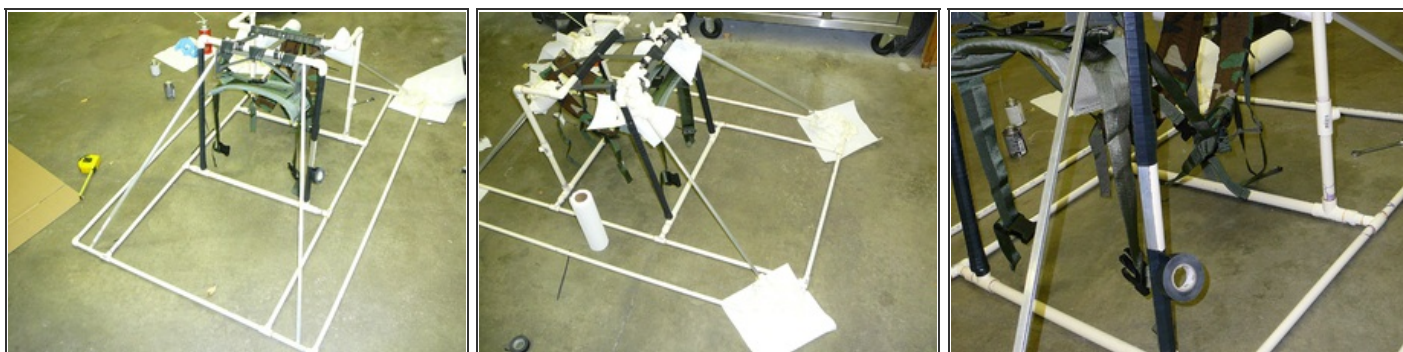
Step 15
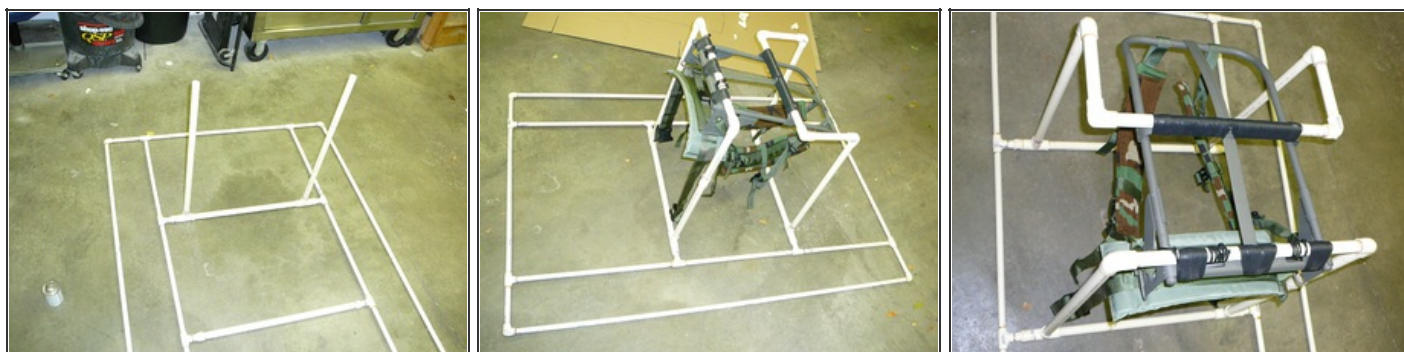
- I added some pipes coming straight out from the wall crossbars to attach to the backpack frame.

- I should have planned better, but because I didn't the pipes are too narrow for me to fit in between the way I had planned, so I had to modify things and put a 90 degree bend in t make room for my shoulders.

- I was worried about this design idea because the pipe isn't the strongest thing in the world, but decided to give it a go anyway.

Step 16

- When I finally got things all glued together I tried it on. While it did work, there were problems.

- As I'd feared, the pipe wasn't nearly rigid enough and there was a lot of sag in the system. That was without all of the extra weight that still needs to be added, so clearly this wasn't going to work.

- After bouncing some ideas around overnight I decided that a whole new idea might be the best solution, but that's not really an option since I have money/time into this setup.

- I decided to go buy some angle aluminum stock from Tractor Supply (It was a lot cheaper than Home Depot or Lowes) and use that to brace things.

- I put in four diagonal braces. One from each corner to the backpack frame.

- I also attached the aluminum to the pipes that connect the wall and backpack frame. I just used electrical tape for this too.

Step 17

- Here are some pictures of the diagonal braces and the angle aluminum attached to the pipe.

Step 18
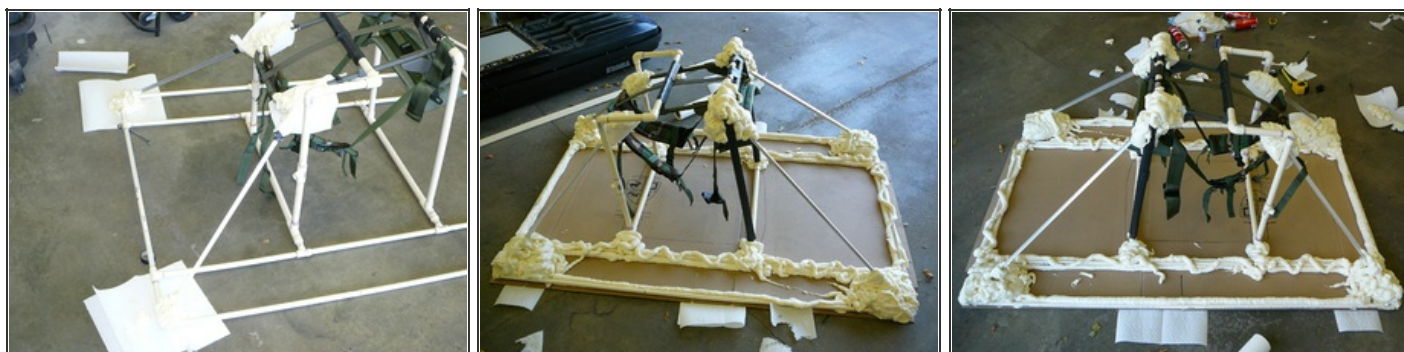
- I finished foaming the supports in and went on to attaching the cardboard front.
- I used more expanding foam to attach the cardboard to the PVC. It's a messy way to do things, but it's cheap and you get a lot in one can, so that's my route.
- I also cut out space for my shoulders in the foam at the top of the backpack frame.

Step 19

- Once the foam was set it was time to start attaching the mirror to the frame. I used four PVC straps to do this. I don't have a picture, but they're with the rest of the CPVC joints at the hardware store.
- I'd designed the wall frame to match up with the wood in the mirror and it fit perfectly.
- I cut a hole slightly smaller than the mirror and used the brackets to attach the mirror to the wall frame.
- It's a little crooked, this will be fixed later. I have to remove the mirror to paint the wall anyway and this was just a test-fit.

Step 20

- I though about using a pre-printed stone wall backdrop, but I like to have something that looks 3D, so I decided against it. It would have looked much nicer though.
- Instead I decided to go with upholstery foam that I got at Michaels. I used Super 77 spray glue to attach the foam, and then tacked each corner of foam down with hot glue.
- A friend helped me spray down the whole thing with gray primer paint, and then I hit it with some stone texture spray paint.

Step 21

- In my over-tired haste I somehow forgot that I might want to see out of this thing and "bricked" right over the area I'd planned to cut a hole to see through.
- I removed two of the foam blocks, cut a hole out, and glued in some black see-through fabric.
- I also realized that the black fabric covering the back of the costume would be resting on my head, so I made a quick CPVC hoop and taped it to the frame. That way it will rest on the hoop, not my head.

Step 22

- When I built Pacman I learned that even if it's dark inside the costume, people can still see light colored objects through the sheer fabric. The fix for this is to paint the inside of the costume black.

- I sprayed the whole upper portion of the insides black. I got areas that wouldn't make a difference, but I'm trying to get rid of some old spray paint, so anything worth doing is worth over-doing.

- Then I finished spraying down the new foam blocks in gray, and put down another coat of stone texture paint.

Step 23

- I got my friend Victoria to help me sew two pieces of black fabric together to make it thick enough that very little light comes through.

- We started attaching the fabric to the costume using straight pins. Once it was all lined up I started attaching it with Amazing Goop Plumbing Glue.

- Two pockets appeared at the folds in the upper edges, so I hand-stitched these together.

Step 24
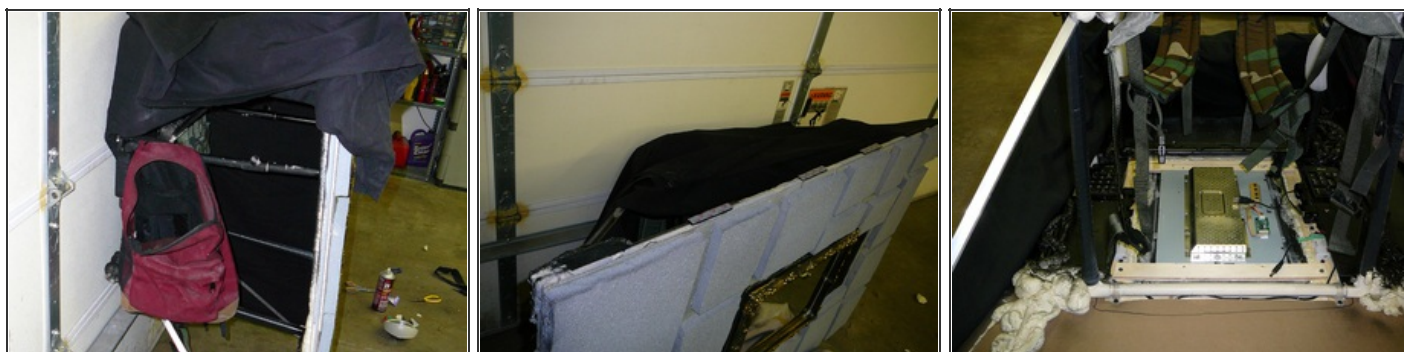
- I realized that I still needed a way to hold the laptop, so I took an old backpack and strapped it to frame.

- Since I need access to this I couldn't glue the fabric all the way around.

- To fix this, I glued velcro onto the frame and onto the fabric. This will give me easy access to the backpack, and allow me to close up the costume.

- I also glued my two USB number pads into the costume to act as my remote controls for the laptop.

Step 25

- The harness isn't the most comfortable, so I took some left over foam and attached it to the harness using electrical tape.

Step 26

- The completed costume!

- The first picture is of the top 10 finalists at a big Halloween Costume Contest. It's the only picture I could find, and I'm tucked in at the back.

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